AP Statistics Practice Test (page 797)

T12.1 c. There is no sample size limitation.

T12.2 b. The association looks quadratic (a power model), so taking the square root of *y* or the log of *x* and log of *y* makes the most sense.

T12.3 d. The appropriate distribution is *t* with $n-2$ degrees of freedom.

T12.4 a. The correlation is the square root of r^2 and has the same sign as the slope.

T12.5 d. The test statistic is $t = \dfrac{-4{,}139{,}198 - 0}{1{,}698{,}371}$.

T12.6 d. The *P*-value measures how likely it is to get a sample result at least as extreme as the observed result, assuming that the null hypothesis is true.

T12.7 e. With 67 degrees of freedom, the appropriate t^* is 2.00.

T12.8 d. These are the two highest values on the graph.

T12.9 d. For power models the graph that is linear is the logarithm of *y* versus the logarithm of *x*.

T12.10 c. $\widehat{\log y} = -13.5 + 0.01(2020) = 6.7$ so $\hat{y} = 10^{6.7} = 5{,}011{,}872$.

T12.11 (a) $\hat{y} = 4.546 + 4.832x$ where *y* is the weight gain and *x* is the dose of growth hormone.
(b) (i) For each 1 mg increase in growth hormone, the predicted weight gain increases by about 4.832 ounces. (ii) If a chicken is given no growth hormone ($x = 0$), the predicted weight gain is 4.546 ounces. (iii) When using the least-squares regression line with *x* = dose of growth hormone to predict *y* = weight gain, we will typically be off by about 3.135 ounces. (iv) If we repeated this experiment many times, the sample slope will typically vary by about 1.0164 from the true slope of the least-squares regression line with *y* = weight gain and *x* = dose of growth hormone. (v) About 38.4% of the variation in weight gain is accounted for by the linear model relating weight gain to the dose of growth hormone.
(c) *State*: We want to perform a test of $H_0: \beta = 0$ versus $H_a: \beta \neq 0$ where β is the slope of the true regression line relating *y* = weight gain to *x* = dose of growth hormone. We will use $\alpha = 0.05$. *Plan*: If the conditions are met, we will do a *t* test for the slope β. We are told to assume that conditions are met. *Do*: The computer output reports *t* = 4.75 and *P*-value = 0.0004. *Conclude*: Because the *P*-value of 0.0004 is less than α = 0.05, we reject H_0. There is convincing evidence of a linear relationship between the dose of growth hormone and weight gain for chickens like these.
(d) *State*: We want to construct a 95% confidence interval for β, the slope of the true regression line relating *y* = weight gain to *x* = dose of growth hormone. *Plan*: If the conditions are met, we will construct a *t* interval for the slope β. We are told to assume that conditions are met. *Do*: With df = 15 – 2 = 13, the confidence interval is

$4.8323 \pm 2.160(1.0164) = 4.8323 \pm 2.195 = (2.6373, 7.0273)$. *Conclude*: We are 95% confident that the interval from 2.6373 to 7.0273 captures the slope of the true regression line relating y = weight gain to x = dose of growth hormone for chickens like these.

T12.12 (a) There is clear curvature evident in both the scatterplot and the residual plot.

(b) Option 1: $\hat{y} = 2.078 + 0.0042597(30)^3 = 117.09$ board feet.

Option 2: $\widehat{\ln y} = 1.2319 + 0.113417(30) = 4.63441$ and $\hat{y} = e^{4.63441} = 102.967$ board feet.

(c) The residual plot for Option 1 is much more scattered, while the residual plot for Option 2 is curved, meaning that the model relating the amount of usable lumber to cube of the diameter is more appropriate. Thus, the prediction of 117.09 board feet seems more reliable.